SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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The Royal School of Mines, Jermyn Street.

Mr. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

Lecture LVII.—It is now necessary (said Mr. Smyth), in approaching the termination of our course, to devote a few lectures to the mechanical apparatus with which the preparation of ores for the market is now carried out with such completeness. These processes (which the miners call "dressing") not only include metallic produce, but all kinds of coal require more or less cleaning, picking, or screening. All these operations depend chiefly upon the nature of the substances to be dealt with; as, for instance, in some cases the valuable material is diffused in minute particles, or in small proportions, through a mass of refuse, while in others it is the preponderating matter. Very much often depends not only upon the actual chemical character of the metal to be extracted, but its specific gravity. With coal nothing is more important to the owner than that he shall offer his coal to the purchaser in such a fashion as suits the particular object for which it is to be used. Thus, house coal may be of small size, but should be free from dust; while in furnace coal dust is of no consequence. House coal, moreover, should be carefully freed from shale and iron pyrites, and if a particular coal is known to be "dirty," as it is called, it will soon lose its chances of sale. In some cases it is sufficient merely to apply a stream of water, so as to throw the orey minerals into a state of suspension, and then the different specific gravity of the substances contained in it will fall to the bottom at periods different to each other. This principle plays an important part in the preparation of many ores and valuable substances. Take, for instance, the case of china-clay, which was discovered by Mr. Cooksworthy in the last century, and which has now in the granite districts of Cornwall and Devon grown to a trade of gigantic scale, 80,000 tons per annum being sent from those counties to the Staffordshire Potteries. China-clay is found in the decomposed granite, where the felspar is changed from a solid state to a powdery condition. A stream of water is then applied, and it becomes a fluid mixture, which is passed through a series of shallow troughs, called "mica pits," in which more or less deposit takes place. Towards the end of the series the water is found to have carried off all the impurities, and left the china-clay in a state fit for market. In some instances, however, the mica is got rid of with great difficulty, in which case it is led into a deep pit, and left for days, the clay forming a deposit at the bottom of the water, and the mica floating at the top. In fine summer weather the mixture is conducted into shallow pools, and when the water has evaporated the clay is left behind in a comparatively pure state, deposited at the bottom in a mass, which is then cut up with shovels in the form of a thick paste. When the weather is not suitable, artificial means of evaporation are employed. This kind of process in various forms is used in the case of a great number of metals, and the material is prepared for the action of the water in some of them by being finely triturated. The process is varied according to the different intrinsic values of the metal. With regard to iron ore, as a general rule it is not worth working at any great distance from the furnace if it does not contain 30 per cent. of metallic iron. Of course the price must be taken into consideration, as that may be too small to leave sufficient margin for much expenditure upon dressing at the pit's mouth. Sometimes the question whether or not the impurities shall be removed depends upon what the impurity is. Take, for instance, the well-known hematite iron of Cumberland. Although crystals of quartz may be associated with it, their presence may not be so plentiful as to interfere with the value of the ore, but if the spats of quartz run all through it, the value of the ore is depreciated. Then, in order to deal with ores of a certain class, the process of dressing must be worked cheaply, and rail or water carriage easily attainable. Some qualities of ores which formerly could not be touched are now dressed solely because in these days the production and application of power is cheaper and more effective. When we come to metals of higher intrinsic value the nature of the consideration changes. [The lecturer here exhibited a large number of specimens of ores, pointing out in each the different minerals with which the more valuable metals are associated.] Amongst others was an excessively rich specimen of tin ore, mingled more or less with chlorite and quartz, but there were others in which the crystals of tinstone were few and far between. If 1 per cent. of good saleable tin can be obtained from the material, that would be exceedingly good; if it be as little as ½ per cent., it is in Cornwall considered a fair ore, but many go below that. The nature of the dressing depends, too, upon the degree up to which the smelter requires it to be carried, and many ores are now dressed up to a high percentage. Thus, the smelter requires copper to be dressed up to 6 or 7 per cent., and in foreign mines the percentage is even higher. Some kinds of copper, the black oxide for instance, falls an easy prey to the weather, and is carried off by water in suspension from the material with which it is associated, so that in a mine of this quality after wet weather the puddles may be observed to be tinged with copper. When we come to the precious metals the percentage is very small. Thus, for instance, at the St. John del Rey Mine, in Brazil, a large proportion of the ore obtained yields no more than two-eighths of an ounce of gold to a ton of refuse, a very small proportion, and yet that well-known mine has yielded extremely large profits. At Shemnitz and Cremnitz, in Hungary, the quantity of gold is but 2 ozs. to 50 tons of material, in which, however, there are other metals, but water-power being abundant, and labour cheap, the mines are very successful. At Zell, in the Tyrol, and at Saltzburg, the proportions are about the same; but if we leave the auriferous rock, and go to the sand drift of the Ural Mountains, from which gold is obtained, the proportion of the precious metal to the material acted upon is but from 4 to 6 parts in 1,000,000. This appears to be very small, and it is obvious that the cost of dressing should be as low as possible, and as efficacious. How important, then, to know what class of machinery to use to produce the best results, and which is best fitted to the nature of the material to be acted upon. On the Continent there are many elaborate treatises on what we call "dressing," and the Germans "aufbercitung," but in England the information must chiefly be sought for in works devoted to other although cognate topics. With respect to gold and silver, I may mention an excellent work lately published by Mr. J. A. Phillips. A good deal may be gathered from Sir H. De le Beche's reports on Cornwall and Devon; a paper of mine on the methods employed in the lead and silver mines of Cardiganshire in preparing the ores; Foster's Sections of the Strata; and Farey's work on Derbyshire. Those who have the advantage of reading French and German will find in the scientific magazines of those countries a great deal of useful information—more, in fact, than anyone is able to master who knows nothing of practical operations. In French, a book by M. Coombes takes up the subject generally; but the most elaborate work is that of Prof. Gatzschmann, of Freiberg, a German professor. The work most in repute in Austria is that of M. Rittinger, chief mechanician, for dressing purposes in that country, which gives a full description of all the mechanism employed in preparing ores.

With regard to the separation of the different qualities of ore a good deal depends upon the condition in which the ore reaches the surface. In some mines it is so bedaubed with clay and begrimed with powder smoke that it is impossible to tell by the eye what it is, and washing must go on before the first attempts at division. The smallest is passed over a riddle or screen, and then the larger blocks are broken up by what is called "spalling," the spalling hammer having a head which weighs from 6 lbs. to 8 lbs., and the work is generally done by the piece. Sometimes it is crushed by machinery, and the material is required to be spalled down to the size of walnuts. Then the material is divided at once into three or four different classes.—1. The best, which may be at once sent to the market without further process.—2. "Dradge ore," which is more or less mingled with impurities, and requires further trituration and division.—3. "Halvans."—And, 4. "Attle." Besides these there are the "smalls," or what will pass through a small riddle. These arrangements or operations go under different names in various localities. Thus, in Derbyshire, what goes at once to the market is called "bing ore;" the next quality, "dashwork," or "knockings;" and another variety is called "riddlings." These preliminary processes are very much facilitated by a fall of water, and all the small stuff made in spalling is passed off to what is called a "grating," consisting of parallel bars of iron an inch apart. M. Rittinger has invented an ingenious grating, which divides the material passed over it into four different sizes. [The lecturer concluded by exhibiting models of this and a number of the other apparatus.]

The British Association.—At the last meeting of the Council, Sir Roderick Murchison in the chair, it was reported by the general secretary that the following Presidents of sections had consented to preside at the Exeter meeting. The following Vice-Presidents were nominated:—Section A (Mathematical and Physical Science)—President, Prof. Sylvester, F.R.S.; vice-presidents, Prof. Adams, F.R.S., and Mr. W. R. Grove, Q.C., F.R.S. Section B (Chemical Science)—President, Dr. Debus, F.R.S.; vice-presidents, Prof. Odling, F.R.S., and Prof. Williamson, F.R.S. Section C (Geology)—President, Prof. Harkness, F.R.S.; vice-presidents, Mr. R. Godwin-Austen, F.R.S., and Mr. W. Pengelly, F.R.S. Section D (Biology)—President, Prof. Rolleston, F.R.S.; vice-presidents, Mr. C. Spence Bate and Mr. E. B. Tylor. Section E (Geography)—President, Sir Bartle Frere; vice-presidents, Sir George Grey, K.C.B., and Mr. A. G. Findlay, F.R.G.S. Section F (Economic Science and Statistics)—President, the Right Hon. Sir Stafford H. Northcote, M.P.; vice-presidents, Mr. T. D. Acland, M.P., and Colonel Sykes, M.P., F.R.S. Section G (Mechanical Science)—President, Mr. C. W. Siemens, F.R.S.; vice-presidents, Mr. G. P. Bidder, F.R.G.S., and Mr. C. Vignoles, F.R.S. The Mayor of Exeter, Sir Stafford Northcote, and Sir John Bowring were present, and supported the application of the working men for a special lecture during the meeting, which was unanimously agreed to; and subsequently Prof. W. A. Miller, vice-president and treasurer of the Royal Society, was invited to undertake the duty.

THE MINERAL RESOURCES OF THE MISSISSIPPI VALLEY.

The connection of physical geography with geology has frequently been pointed out in the *Mining Journal*, and of the closeness of this connection the information contained in Dr. J. W. Foster's volume on the Mississippi Valley* contains abundant additional evidence. Dr. Foster's position as President of the American Association for the Advancement of Science is a sufficient guarantee for the reputation which he enjoys in America, whilst Messrs. Foster and Whitney's report on the geology of the Lake Superior region, of which he is the joint author, affords ample evidence of his ability as a geologist. The bed of the Mississippi, all the way from Cairo to the Gulf, is not formed of its own alluvium, but is excavated in a tough blue clay of cretaceous origin. Outside of the immediate valley the cretaceous rocks extend on either side of the mouth of the Ohio to within 70 miles of the Gulf, where they are overlapped by the tertiaries. There is little doubt of the former continuity of these beds, or, in other words, that the cretaceous sea extended from the Rocky Mountains to the Atlantic coast; it is evident, therefore, that the course of the lower Mississippi has been determined subsequent to the cretaceous age, since its bed has been excavated in that formation. It would further appear that during the tertiary epoch there must have been an estuary extending as far north as the mouth of the Ohio, as indicated by the wedge-shaped body of these rocks observed there. Dr. Foster considers that the origin of the river is subsequent to the tertiary epoch, since outlying patches of this formation cap the summit of some of the hills of Illinois far beyond its ancient limits, and all of the associated fossils are of marine origin, thus showing that no large body of fresh water was discharged at this point into the tertiary ocean. In the deposition of the loess, however, there is evidence that at that period the river had assumed its present channel, but with a vastly enlarged volume of water. The fossils are all of fresh-water origin, and of existing species, intermingled with quadrupeds, for the most part pachyderms, now extinct, but allied to existing genera, which indicate the immediate presence of land under conditions of soil and vegetation such as now prevail; and yet, to account for the present position of the loess, as pointed out by Lyell, a vertical movement or upheaval of 250 ft. must be pre-supposed.

In the next chapter Dr. Foster sketches the physical features of the United States, especial attention being given to those portions of the country not likely to be well known to the general reader. The country has within itself elements of wealth such as are possessed by no other nation. On other continents, he remarks, the progress of the nation and the unity of the people have been interrupted both by physical restrains, such as impassable mountains and vast deserts, and by artificial restraints, such as civil disabilities and inequality of condition. The feeble barrier of the Cheviot Hills, says Mrs. Somerville, between England and Scotland, and the moderate elevation of the highlands, have prevented the amalgamation of the Anglo-Saxons and Kelts even in a period of high civilisation. Thus slight physical barriers have controlled the migration of races, and checked the spread of civilisation. The United States, with the internal improvements already completed, presents no such obstacles to intercommunication. With a vast body of agricultural lands in the interior capable of producing a diversity of products, with great manufacturing capacities at one extreme and great mineral resources at the other, the whole intersected by navigable rivers and far-stretching railroads, by which expeditious communication is had with the most distant parts, and maintaining an oceanic commerce both with Europe and Asia, soon to be more intimate than that of the most favoured nations—all these conditions Dr. Foster regards as conducive to national strength and unity, although it is probable that so far from this being the case many now living will see the present United States again overwhelmed with the horrors of civil war, and the country divided into at least four separate nations—one comprising, perhaps, the country to the west of the Rocky Mountains; the second embracing the district from the Mississippi westward to the boundary of the first; the third occupying the present Southern States east of the Mississippi, taking the northern boundary of North Carolina as the limit; and the fourth consisting of the present Northern States north of the boundary line of the third. History tells us that republics degenerate into despotisms, and the most that can be hoped for by those entertaining the best wishes for the future of the United States is that the dismemberment will be effected with the least possible bloodshed, and that such free institutions as the Americans now enjoy may be retained. But not troubling himself with such sombre thoughts as these, Dr. Foster, as an American, very properly eulogises the political system and vast natural beauties of his country; and then referring to its physical apects, observes that its vast primeval forests of rich and varied verdure; its almost boundless plains of waving green, spread out far as human vision can range; its noble rivers thousands of miles in length, often expanding into inland seas, which serve as the great highways of an extended and prosperous commerce; its lofty mountains, whose crests penetrate high into the region of perpetual snow, and whose flanks are stored with the precious metals; all, Dr. Foster thinks, remind the statesman and the philanthropist that here (in the United States) are the elements of material wealth and of human power such as the world never saw; that here is a field for the display of the most vigorous manifestations of physical or intellectual force, and that here under a beneficent form of government man may rise to his true dignity—a position in the order of creation, "A little lower than that of the angels."

Referring to the origin of prairies, Dr. Foster explains the distribution of forest, prairie, and desert; maintains that prairies are not due to peat growth, nor to the texture of the soil, nor to the annual burnings; describes the five zones of vegetation on the North American Continent resulting from its climatic conditions, and discusses the sources of moisture. Regarding the Gulf of Mexico as the proximate source of the rains which water the Great Valley, many phenomena can be explained which are inexplicable, on the supposition that the south-west winds are the great water-bearing current. He maintains that the great changes in the geographical distribution of plants under nearly equal lines of temperature are not due to the mechanical texture or chemical composition of the soil, but to the variable supplies of moisture, and that in the winds as the agent in the distribution of that moisture there is an adequate cause to explain all the phenomena of forest, prairie, and desert. He observes that if we examine a geological map of the world we shall find that the vast plains and deserts were sea bottoms during the cretaceous, and in many instances during the tertiary epoch, and the mountains by which they are girt were the ancient shore lines. But this does not justify the inference that their desert-like character is due to this cause, for all the sedimentary rocks, which generally afford a far more hospitable soil than those of igneous origin, have undergone the same process. It is probable that if the most inhospitable portions of Sahara had been exposed to the direct action of the winds of the region of monsoons, the inundations of the Nile, they would have been robed with an appropiate vegetation, whose decay in the course of ages would have created an amount of humus, which, incorporating itself with the soil, might have made this desolation a garden. He urges that the phenomenon of varying vegetation throughout every continent and throughout every zone is primarily dependent on the varying supply of moisture, modified secondarily by altitude of surface above the sea, diversity of soil, its evaporative power, and the climatic conditions of temperature. The winds and the rains, heat and cold, light and darkness are the great powers which everywhere act in accordant harmony to produce the infinite diversity of vegetable life: they are the agents by which Nature perpetually renews the youth, the beauty, and the fertility of our planet. And yet all these apparently complicated phenomena are but emanations from a single source—the Sun. To solar influence may be traced all the great phenomena which affect the surface of the earth—day and night, heat and cold, atmospheric and oceanic currents, and the vicissitudes of the seasons, and extending even to the oxygen of the atmosphere, which to man is "the breath of life."

* "The Mississippi Valley: its Physical Geography, including sketches of the Topography, Botany, Climate, Geology, and Mineral Resources; and of the Progress of Development in Population and Material Wealth." By J. W. Foster, LL.D.,&c. Chicago: Griggs and Co. London: Trubner and Co., Paternoster-row.

The consideration of forest culture and irrigation occupies the fifth chapter, in which he explains how plants grow, the effects of forests on health and on animal life, the effects of disrobing a country of forests, and other allied matters; whilst in the following chapter he deals with climate, commencing with a general definition; and then discussing atmospheric currents, rains, and winds, cloud bursts, isothermal lines, gulf stream, evaporative power of winds, isotherms of the United States, the climate of the Pacific and Great Basin, and the phenomena of the seasons. This chapter is greatly enhanced in value by the addition of two elaborate tables, the first being a table of temperatures in the United States, and the second a table showing the annual precipitation of rain at several stations in the United States. The chapter on the cultivated plants of the district is particularly interesting, and contains a large amount of really valuable information. Referring to the prairies, he remarks that nowhere on the Continent is a farm so easily subdued, and nowhere are the processes of agriculture performed with so slight an expenditure of human strength. The spade and the hoe are seldom resorted to, and the furrow is formed by the plough. Planting, sowing, reaping, raking, binding, threshing, shelling, all are mainly done by machinery, processes which in many regions are impracticable by reason of the inequality of the soil, the presence of stumps, rocks, and other impediments. The product of cereals in the eight food-producing States for the year 1859, based on a crop which was nearly one-third deficient, exceeded 550,000,000 bushels. After feeding the existing population of those States there remained a surplus of more than 500,000,000 of bushels to be used as seed for future crops, as food for the domestic animals, and for exportation either in a crude state or in a concentrated form, as beef, pork, lard, oil, whiskey, &c. The amount of cereals which in 1862 flowed out of the lake region to the seaboard was in excess of 136,000,000 bushels, since which time it has greatly augmented.

But it is the three succeeding chapters in which the readers of the *Mining Journal* will be more especially interested, for in them Dr. Foster describes the geology of the district under review. He tells us that a bird's-eye view of the entire structure of the Mississippi Valley would show it rimmed on three sides by granitic, or highly metamorphic, rocks, at many points invaded by products of a purely volcanic origin. The basin is filled in with stratified rocks, lying for the most part nearly horizontally, such as limestones, sandstones, shales, and loose detrital materials, the whole forming an assemblage many thousand feet in thickness. Directing his attention to those substance useful to man, one finds in the granitic, volcanic, and metamorphic rocks gold and silver; and the baser metals—copper, tin, zinc, mercury, lead, iron, &c.—sometimes segregated in veins, and at others in beds or sheets incorporated with the strata. In the limestones, sandstones, and shales, which show some slight signs of igneous action, while he notes the absence of the precious metals, he finds the more useful ores, such as iron, lead, and zinc. In addition to these, he finds at various intervals, and stretching over vast areas, immense deposits of fossil fuel, stored away at accessible depths, and in positions protected from combustion and decay, to supply the wants and conveniences of man throughout all time. To investigate the structure of the globe, and the revolutions which its surface has undergone, to trace the succession of animal and vegetable life, to determine the conditions under which the precious metals and the useful ores are found, and to bring forth from hidden depths those materials which minister to the conveniences of man is, according to Dr. Foster's views, the province of geology, in which definition he certainly does not err on the side of incompleteness. In this chapter a very valuable table, which we subjoin, is given, showing the classification of the more conspicuous groups of rocks in the Great Valley.

Tabular View of the Principal Fossiliferous Strata of the Mississippi Valley and Pacific Slope.

1.—Recent	Post Tertiary			
2.—Loess, or Bluff				
3.—River Terraces				
4.—Drift or Boulder Group				
5.—Loup River Group	Pliocene	Tertiary	Neozoic.	
6.—White River Group	Miocene			
7.—Wind River Group				
8.—Fort Union or Great Lignite Group	Eocene			
9.—Vicksburgh Group				
10.—Fox Hill Group	Cretaceous	Secondary		
11.—Fort Pierre Group				
12.—Fort Benton Group				
13.—Dakota Group				
14.—Auriferous Slates of California	Jurassic and Triassic			
15.—Laminated Marl of Black Hills				
16.—Variegated Marls of Colarado?				
17.—Variegated Marls of Kansas?				
18.—Fort Riley Group, Kansas	Permian			
19.—Coal Measures	Carboniferous	Primary	Palæozoic.	
20.—Chester Limestone				
21.—St. Louis Group				
22.—Keokuk Group				
23.—Burlington Limestone				
24.—Kinderhook Group				
25.—Hamilton Slates	Devonian			
26.—Coniferous Limestone				
27.—Oriskany Sandstone				
28.—Salina Limestone	Upper Silurian			
29.—Niagara Limestone				
30.—Cincinnati Blue Limestone	Lower Silurian			
31.—Galena Limestone				
32.—Trenton Limestone				
33.—St. Peter's Sandstone				
34.—Lower Magnesian Limestone				
35.—Potsdam Limestone				

The Azoic series, Dr. Foster states, is characterised by the abundance of iron; copper is associated with the first-formed sedimentary rocks, or rather their igneous products; lead predominates in the lower silurian and sub-carboniferous series; silver is of the carboniferous age, and even of that of the tertiary volcanic rocks; gold appertains to the triassic; and mercury to the cretaceous.

While the age of a group is determined by the assemblage of fossils, it must be understood that they are not in all instances restricted to a particular zone of life, but certain specific forms are found to range through several distinct formations. In such cases they generally appear as varieties, as though the surrounding conditions had so far changed as to produce variations in their form and character. While the extremes differ in these particulars, there is a series of gradatious, the result of altered conditions of habitat, which link them together. The igneous rocks of the region, like the fossilliferous strata, are not all of the same age. For instance if, as on the shores of Lake Superior, he observes, we find the Potsdam sandstone abutting against a great boss of granite, with all of its projections worn off, like rocks at the present day on the sea shore exposed to the action of a heavy surf, while the sandstone reposes on horizontal beds, and shows few signs of metamorphism, we infer, and justly too, that the granite was upheaved and assumed its present relative position before the deposition of the sandstone. If, on the other hand, we go to the Rocky Mountains, and observe granite in the form of domes or crests, constituting mountain masses, flanked by triassic strata, reclining at a high angle, and if we find that where such contact takes place sandstone is metamorphosed into quartz, shale into gneiss, and limestone into marble, we infer that the granite has been protruded through the yielding strata, and that this change in the sedimentary rocks is due to the action of direct or transmitted heat. As this is the usual form in which granite appears, and never in the form of a lava overflow, it is inferred that it was elevated in a pasty condition, and under circumstances which permitted it to assume a crystalline form. We also observe another class of rocks, occupying narrow apertures in the pre-existing strata in the form of dykes, or diffused over the surface, sometimes in aspect compact and close grained, at others glassy and scoriaceous. These rocks intermingle with the fossiliferous strata, and resemble so much the product of modern volcanoes, that geologists have not hesitated to ascribe their origin to this source. He then goes on to describe the varying systems of elevation, classifying them as the Lake Superior system, the Appalachian system, and the Rocky Mountain system. Subordinate systems are known to exist, and others will, undoubtedly, be determined, but he considers that it is to these three great lines of upheaval that the Mississippi Valley owes its configuration.

With regard to the classification of the formations, Dr. Foster gives abundant information, stating the districts in which the several systems are most largely developed, and explaining the various deposits which are turned to industrial advantage. Throughout the chapter he appears to have taken every care to facilitate the comprehension of the physical history of the revolutions of the earth's surface, as attested by geological monuments, which reach back to the dawn of organic life, remarking that while to some they may indicate the reign of waste and chaos, yet throughout all these phases we can detect design—in the concentration of the useful metals in veins and beds; in the storing away of vast supplies of fossil fuel; in the consolidation and upheaval of the strata, giving relief and depression to the surface; in their subsequent erosion and dispersion to form soil; and in all the changes which these material elements have undergone—a design to fit the earth for the habitation of man, and to afford him useful materials for the exercise of his industry, and the promo-

tion of his comforts and conveniences. The remaining chapters of the book are devoted to the consideration of the effect of climate on man, to the origin of civilisation, and the progress of development: but from the space we have already devoted to the notice of the work we cannot do more than merely mention their existence.

To those interested in the development of the mineral resources of the United States the work will prove invaluable. It gives precisely the kind of information which the practical explorer can utilise, whilst it is given in a style at once brilliant and attractive. The book is free from the Yankeeisms which too frequently disfigure the writings of American authors, yet possesses all the vivacity and perspicuity for which American writers have become celebrated. The views entertained by Dr. Foster do not in all cases accord with those entertained in this country, but it must be remembered that an author has, at least to some extent, to suit the taste and opinions of those whom he anticipates will read his writings, and cannot always strike out a path for himself. Whether for its practical utility, or for the style in which it is written, Dr. Foster's account of the physical geography of the Mississippi Valley is worthy of a favourable reception in this country, and is calculated to increase the author's already high reputation in America.

Original Correspondence.

THE PATENT LAWS.

There was an interesting discussion in the House of Commons in reference to the abolition of the Patent Laws. The proposition was brought forward by Mr. MACFIE, and seconded by Sir R. PALMER. Doubtless these gentlemen and the few other members who supported the resolution for the entire and unqualified repeal of the Patent Laws were actuated by the best of motives. They founded their remarks upon the old stock argument that patents were simply monopolies, which proved injurious to the free development and further expansion of trade, and that, consequently, anything like protection should not be given to any person, no matter how valuable his invention, or the skill, ingenuity, time, and expense expended in perfecting the production of his brain. The answers given by practical experienced men, such as Mr. J. HOWARD, Mr. MUNDELLA, Mr. SAMUDA, &c., were most complete. Mr. MACFIE expressed himself as satisfied with the discussion, and his proposition died of its own inherent weakness.

The question before the House went at once to the root of the trade and manufactures of this country, and is intimately connected with that vitally important and absorbing topic—the Labour Question. We have no hesitation in stating at the outset that were the Patent Laws of this country entirely and unconditionally abolished the large manufactures would soon have the greatest cause for regret, for they would have far more severe competition to contend with then that they have now; and it is a well-known fact that in the production of many of the staple articles of this kingdom the manufacturers find it somewhat difficult to hold their own against the competition already existing. It is a matter of surprise to find that some of the prominent men of this country appear so anxious to deprive the engineer, the mechanic, the manufacturer, and the artizan of any adtantages possessed; to throw open the gates of commerce and trade to foreign competition, and to initiate measures which other nations and foreign manufacturers are so unwilling to follow. If the French, the continental nations, and our American friends would at the same time afford equal facilities to the English manufacturers and engineers, then the question would be placed upon a different footing, but even then it would be questionably policy to repeal the Patent Laws of this country. But, as now suggested, the laws of this country repealed, nothing could prevent any other nation adopting the invention of the English skilled engineer or machinist, manufacturing the article in a foreign country, and turning the ingenuity of the Englishman, devised for the benefit of his own country, into one of the most powerful competitions against him. And whilst this was the case, foreign nations would guard with the most zealous care and watchful attention the slightest infringement upon their own productions, and would pounce down upon the English manufacturer for invading his just rights and privileges. Abolish the Patent Laws of England, and not only is the door of foreign competition thrown open still wider than at present, but at the same time is taken away the only incentive and spur to the ingenious engineer and mechanic, and, consequently, England and her large and staple manufacturers would be deprived of many of those advantages which are constantly brought to bear with so much benefit, and which have greatly contributed to the present proud position attained by this country amongst the other nations of the world.

Probably the best definition of the term "Law of Patents" is that afforded by Sir DAVID BREWSTER. He says that "Letters Patent were awarded in the king's name, and under the great seal, which secure for a limited period to the inventor the exclusive right to make and sell the material productive of his own invention. A patent is a monopoly, and (with the exception of the copyright of a literary publication) is the only one *founded on natural right, and sanctioned by justice.*" Probably the great majority of the manufacturers of this country, whose interests we are now advocating, will willingly accept this definition of the great lexicographer, and will admit with us that that which is founded on "natural right, and sanctioned by justice," should not be ruthlessly assailed, still less entirely abolished, more especially when to do so would not only rob the inventor of his indissoluble right—the production of his own brain—but also open the door to foreign competition, which is subservient to the interests of his own nation. We quite admit that, as a rule, monopolies are hostile to the principles of equality recognised in a free commonwealth, and destructive of that unrestrained competition which is essential to the public prosperity; but we contend that the Law of Patents is based altogether upon a different principle, and neither the State nor an individal has any more right to the inventive genius of a man's own brains than he has to the watch in his pocket, or the coal and iron mines in a landed proprietor's estate.

Whilst we would emphatically protest, therefore, against the entire repeal of the Patent Laws, as tending to thwart the efforts and the labours of men of genius and science, and as inimical to the best interests of the manufacturers of this country generally, we are far from saying that there is not ample room for amendment, so far as the law itself is concerned. The Law of Patents was founded by CHARLES I., and that monarch fixed a period of 14 years as the time the inventor should have the exclusive benefit of his own production. We presume the object was, as the article was for the public benefit, that the invention should be thrown open to the public after the inventor had enjoyed the exclusive right for a reasonable term. Such remains the law until the present day, but whether the term could not be modified, and ten or seven years substituted for fourteen, is a question upon which much difference of opinion exists. For our own part we are inclined to think that the term of the patent should be fixed according to the utility and value of the article patented, and the labour and scientific research brought to bear in the production. Again, patents should not be granted as a matter of right. There should be some separate and distinct thought evolved out of the mind of the would-be patentee, and that thought produced into some tangible, practical form. That many useless patents are sought for, and in some instances obtained, cannot be denied; and that much time and expense are also thrown away is equally apparent. Mere novelty in construction should not be considered a test of merit—there should be some real, substantial benefit gained before an exclusive right should be granted. As the Patent Laws now exist, there is some force in the argument that they interfere with trade, and cripple improvements in manufacture. A manufacturer dare scarcely make any alteration or improvement in his machinery or mode of production, fearful lest he should fall into some plan or device which has been patented; but this is the fault of the administration of the laws rather than the laws themselves. As originally made, no such event could happen; and had the plan propounded by our forefathers been literally and rigidly adhered to, no such impediment could exist.

We have said that improvements in the administration of the Law of Patents should be carried into effect, and we believe that two things are necessary so to do. A competent board of commissioners, sworn to fidelity and secrecy, should be appointed to investigate the claims and pronounce decision upon the claims of any invention for which a patent is applied. This board should consist of mechanical, chemical, and legal men, and should have the power, in specially peculiar cases, to call in as assessors one or two practical men of the particular department of manufacture or trade to which the article belonged or intended to apply. This board should have the power to purchase the invention, if thought desirable, on behalf of the State or the public, either by direct purchase or by annual grant to patentee, according to the general adaptation of the article to the public requirements. The second suggestion we would make is that the specifications of the articles patented should not be given to the public in such minute detail as at present. The title of the article should be full, intelligible, and comprehensive, but we know that the minute detail of the specifications now given is detrimental to the interests of the patentee, and opens the road to others to pillage his invention, many of whom do so with impunity, either escaping detection altogether or defying the patentee, who, perhaps, has not the means, or lack the nerve, to prosecute in a court of law. We believe if these suggestions were carried into effect much good would result both to patentees and the public. The Patent Laws in themselves require supervision and amendment, but on behalf of our engineers, both civil and mining, our mechanics, and our large manufacturers generally, we protest against the repeal of our Patent Laws, as a proposal unjust to the inventive genius and pains-taking perseverance of our engineers and mechanics, and as subservient to the best interests of the nation, and, as such, we cannot but rejoice at the signal defeat of the proposition in the House of Commons.

THE SOUTH STAFFORDSHIRE AND SHROPSHIRE COAL FIELDS—No. IV.

EVIDENCES OF DENUDATION IN AND AROUND THE SHROPSHIRE, SOUTH STAFFORDSHIRE, AND SOUTH WALES COAL FIELDS, AND OF THEIR RELATIONS TO EACH OTHER.

SIR,—Mr. Beete Jukes, in his Geology of the South Staffordshire Coal Field, expresses his belief that "The coal measures in West Bromwich, and generally in South Staffordshire and the adjoining counties, suffered very severely from denudation before the deposition of the Permians, and that the red sandstones of that formation were deposited in hollows worn in the coal measures." And much of the denuded strata appear to have been used over again in the construction of a set of unproductive coal measure rocks, similar to those described in our last, and to others which occur along the boundaries of the South Staffordshire coal fields, variously described as "Wild Ground," "Red Ground," "Blue Ground," "Rough Rocks," &c. Over these still higher beds come in about Halesowen, swelling out the series to nearly 1000 ft. in thickness above the thick coal. The fact that the red sandstone rocks into which these graduate contain fragments of coal measure sandstone confirms and illustrates what we have said in these pages of denudation and reconstruction; the more so as, even including a considerable thickness of Permian rocks, the distance in other places to the thick coal is not half the above, showing that the coal measure by denudation lost hundreds of feet of strata, fragments of which in the form of coal pebbles enter into the rocks above. The extent to which this has taken place is further shown by the fact that the coal measures have been pared down to their foundation, and the Silurian rocks themselves bared, so that the Permians have been laid upon them. The same thing occurs on the borders of the Shropshire field, where in some instances a few poor members of a younger coal series intervene between the new red sandstone and the older rocks, whilst in others these in turn have been denuded, so that the red rocks come down upon the Silurian limestone. And if this is so at the extremities of the estuary, what have we to expect in the deep of the trough?

The long straggling patch of carboniferous rock, coloured as coal measures on the map, stretching from Coalbrookdale to Bewdley, where they attain an imposing breadth, are very deceptive in appearance, and often raise expectations which end only in disappointments and heavy pecuniary losses. On attaining their greatest breadth, at Bewdley, they send out an arm in the direction of Stourbridge, as if to claim relationship with the East Worcestershire and South Staffordshire fields: pretensions exposed by sections, such as were given in our last, of sinkings and borings east of the Severn, at Shatterford.

We might multiply instances of attempts to discover workable coals for miles along this worthless tract, by men who during the past half-century have sunk fortunes without the least success, and who probably received too much encouragement to do so from an unfortunate prognostication indulged in by Warington Smyth, F.R.S., in the Memoirs of the Geological Survey, before the local effects of denudation on these coal fields were understood so well as now. Speaking of the probability of finding coal beneath the red sandstone, and of the underground continuation of the coal field beyond the point where it was formerly supposed to have been lost, he says:—

"Once cognisant of this fact, we cannot but speculate upon that question which will ere long be one of paramount importance to this country—the extension of coal measures with workable regularity beneath those vast tracts of the red sandstone which occupy so large a portion of the surface in the counties of Warwick, Stafford, Salop, and Chester. Let anyone on a clear day ascend the Wrekin, to the west of the coal district now described, and raise his view above the foreground of pits and waste heaps, and mounds of slag and blazing furnaces, and glance over the undulating fertile tract of red sandstone which for some 16 miles in width separates the works of Priorslee and Madeley from the district of Wolverhampton. In the dim distance his eye will rest on the smoke of the forges, pits, and furnaces of the South Staffordshire coal field, and his attention must be rivetted to the great probability, considering the position of the strata and the form of the ground, of the real continuity, in spite of occasional fractures, of these valuable deposits of the carboniferous period. A closer examination of the details of the composition of the two coal fields will strongly tend to confirm these first impressions, for although points of great divergence in character will have to be noticed, many striking analogies present themselves; and, perhaps, some of the most convincing features of resemblance are those which will be brought to light by a careful comparison of the iron ores."

To mar such a glowing picture, at a moment when every fact tends to show that we have a greater store of coal than had been anticipated by some great authorities, is anything but a welcome task; it is one which facts, however, warrant us in undertaking, and one in the course of which we shall find evidence of denudation having taken place in and around the Shropshire, South Staffordshire, and South Wales fields, to an extent little dreamt of even by those most familiar with its workings, and that extending over a period of time amounting to something perfectly amazing.

It is the well-founded belief of geologists, for instance, that the coal fields of North and South Wales, the Forest of Dean, Shropshire, and Staffordshire were originally one, and that their present isolation arises from causes requiring very long periods for their operation. Dr. Buckland and Mr. Conybeare long since pointed out that the coal districts of Somerset, Gloucestershire, Monmouthshire, and Glamorgan, "though apparently distinct and isolated, are yet connected together by resting on a common base of old red sandstone. They all," it is remarked, "appear to have been formed by a similar agency, and at the same era; to have been subject, at a later period, to the same revolutions; and, lastly, have been covered partially by similar overlying deposits." Consistently with this view the great outlying old red sandstone, and other Silurian hilly tracts of Wales, may have been overlaid, some by coal measures and others, then but a little way above the waters, by a gorgeous mantle of the vegetation of the period. Large portions of the Welsh Silurian region were affected by disturbing agencies, which led to an elevation on the eastern side, and which probably gently elevated the Pembrokeshire and Carmarthenshire districts, thereby subjecting them to denudation by the coal measure waters, the waves of which washed and wasted the newly-formed coast, then but little raised above the margin of the sea, and which, from its long marshy plains, would probably be suitable for the growth of vegetation. In some parts of Wales there appears to have been little to have prevented the quiet formation of successive strata from the lowest Silurians of Carmarthenshire and Pembrokeshire to the highest coal measure of Glamorganshire, but at the close of the coal measure period forces were at work which lifted the coal, the carboniferous limestone, old red standstone, and all above the waters. In the north, east, and south of Wales, with part of the country immediately adjoining, a tract of land existed, the coasts of which were ravaged by the breakers of a sea constantly grinding up the cliffs of old red sandstone, carboniferous limestone, and coal measures of that which forms part of the counties of Hereford, Gloucester, Monmouth, Glamorgan, and Somerset; and it has even been supposed that besides washing these ancient lands they might have been extended through the Bristol Channel, and rounded he northern coast of Wales. It is, moreover, believed that to such an extent were the upturned edges of the older strata acted upon by the new red sandstone sea that lands 6000 feet above it must have been removed and carried away. The Forest of Dean coal field was thereby isolated, but saved from utter destruction by its coast of hard red conglomerate resisting waves which washed out the soft marls around. Looking at the hilly old red sandstone ranges of the Black Mountain of Herefordshire, the Beacons of Brecon, the Carmarthenshire Fens, and others, a larger amount of land must have been removed than now even remains above the sea; and during the progress of such elevations and denudations many of the higher lands formed groups of islands, like the high flat-topped ridges of Llangeinor coal measure district situate in the county of Glamorgan, which stand so boldly out amid their surrounding, winding, and excavated valleys. The Forest of Dean, too, presents another example of an ancient coal measure island, saved from destruction by the accident of its coast being composed of hard red conglomerate and carboniferous limestone, having long enough withstood the dashing of the breakers during denudations that hollowed out the lowland in the soft marl around. Of more extended lines of these old coasts the long range of the Black Mountains, stretching from Herefordshire westward, by the Beacons of Brecon and the Carmarthenshire Fens, into the carboniferous limestones of Llangadoc and Llandulo, furnish a marked example, as also does the high ground stretching in an opposite direction round the east side of the Monmouthshire coal field, which protected the coal measures from denudation by a sea, in the midst of which, at the same period, the Forest of Dean and part of the county adjacent stood as an outlying island. Again and again have our coal fields been saved from utter destruction of the sea, either by their elevation, or by reason of their positions in troughs, in which they were securely sheltered from the breakers of the new red and subsequent seas, which planed down the country, and left their deposits upon the edges of denuded strata, as in the case of Somersetshire and the great coal fields of Glamorganshire and Monmouthshire. No barrier, however, appears to have been sufficient to protect the South Staffordshire and Shropshire coal fields, then raised above the waters; even the old red sandstone, which had done good service in the west, here became a prey to the waves. For although it comes up within a mile or two of the Shropshire coal field, and is, indeed, overlaid by poor, unproductive coal measures in places, it was itself cut down to the Lower Bone and Upper Silurian passage-bed, as shown in a paper prepared by the late George Roberts, secretary to the Geological Society, and myself (read by Prof. A. C. Ramsay, January, 1863); and when it is remembered that the old red sandstone is from 8000 to 10,000 ft. thick, and forms mountains from 2000 to nearly 3000 feet above the level or the sea in the adjoining county of Herefordshire, and that it has been so planed down by the cutting action of waves to a thin wedge, only a few inches thick, one can readily understand how the protecting barrier of the coal measures, being gone, they themselves might be eroded, and a gap made such as we find, 16 miles wide, right through them.

Madeley, June 22. J. RANDALL, F.G.S.

GEOLOGICAL NOTES ON COAL—No. VI.

SIR,—As to the various products of coal which have been turned to useful account, their name is legion. The first product to be mentioned is that well-known spongy mass, called coke, which is coal deprived of its volatile oils and gases. But we need not expatiate on this product in this series of papers, but refer our readers to the remarks on coke in our "Metallurgical Notes on Iron." Then comes gas, the most illustrious of the coal products. It is obtained, as our readers are aware, from the dry distillation of coal in large closed retorts, subjected to heat. In a former paper we said that the inflammable gas found in coal mines was like the gas we burn in our houses, shops, and streets. This, however, is not strictly true. The gas we burn contains more carbon, and burns with a brighter flame, than the gas which is discharged in mines. Besides, our manufactured gas is freed from some of its gaseous elements, which are either non-luminous or deleterious substances, such as ammonia and sulphuretted hydrogen. The ammonia is extracted by making gas pass upwards through a mass of coke, saturated with water—the water having thus the power of absorbing large quantities of ammonia. In this way hundreds of tons of ammonia, so useful to the manufacturer, so valuable to the farmer, are obtained; and by the aid of this ammonia they get from some of the coal shales immense quantities of alum, another valuable product.

Sulphuretted hydrogen, one of the substances given off in the manufacture of gas, is a most noxious element, and if allowed to remain in the illuminating agent we use in our houses would be extremely offensive and poisonous. But, while sulphuretted hydrogen is a very disagreeable and noxious gas, it is a useful chemical agent, and is used by analytical chemists in detecting the presence of copper and zinc. It is separated from the gas we burn by making it pass through slaked lime. But a dozen years ago a better gas purifier was discovered than slaked lime—the rust of iron. The gas is made to ascend through a succession of trays with false bottoms, having this rust of iron upon them; and when the gas has finished its journey among the rusty trays it has lost every trace of sulphuretted hydrogen gas. The rust of iron evidently possesses some advantages over the slaked lime. When the lime has done its work it gives off a most offensive stench, but the iron rust does not. When saturated with gas it is only needful to expose the trays to the action of the atmosphere for a short time and they are covered with rust again, and ready to purify a fresh quantity of gas. In fact, it would seem as if the rust of iron had been made on purpose to absolve sulphuretted hydrogen. But there are other ingredients in the gas which do not contribute much to its illuminating power—such as carbonic acid, which does not burn; carbonic oxide, which gives a pale blue light; hydrogen, and light carburetted hydrogen, or fire-damp. These are all feeble illuminators. Now, the remaining constituent of our gas is heavy carburetted hydrogen, often called olefiant gas, and that is the great illuminating power. It gives a whiter and more brilliant light than light carburetted hydrogen. Prof. Franklin, the distinguished chemist, tells us that "those flames which, when in combustion, do not deposit solid matter are non-luminous, whilst those which deposit solid matter are, on the other hand, luminous. By this test let us examine the products of the combustion of the different ingredient gases of our coal gas. Carbonic oxide, when burnt, produces a gas called carbonic acid. Hydrogen produces water. Fire-damp (light carburetted hydrogen) does not deposit any appreciable quantity of solid; but the olefiant gas, the only illuminating element of our coal gas, deposits abundant quantities of carbon, and the luminosity of its flame is due to the high temperature to which the solid particles in it become heated."

Now, the great advantages of such a light for shops and streets, houses and factories, can only be fully understood by comparing it with the inferior lights it superseded. Civilisation has made no greater contribution to human knowledge and to human happiness than that of re-conquering again from the night a portion of its conquest from the day. The night of the savage lasts from the descent to the rising of the sun. Civilisation has *now* no night.

But coal yields other products when submitted to dry distillation besides the gas which lights our streets. There is the well-known semi-liquid substance which is distilled off out of the coal retorts in the manufacture of gas, called *gas-tar*, and which in the early days of gas manufacture was felt to be a positive nuisance. Just think what chemistry can now bring out of that unsightly refuse! When this gas-tar is re-distilled a whitish fluid is obtained, scientifically called *benzine*, but which is commonly known as coal naphtha, and frequently used as a cheap light.

They extract from another remarkable fluid the celebrated paraffin. The word paraffin, we may here mention, for the sake of our young readers, means little akin (*parum*, little, and *affinis*, akin), being so named because it has the property of not chemically caring for some other substances. Besides being used as an oil for illumination, it is employed as an oil for machinery, and when so applied, being indifferent to the oxygen of the air, it never becomes rancid and thick, but always keeps its fluidity. Paraffin oil is said to be indestructible by high temperatures, but retains its lubricating properties unimpaired. From the same oil they obtain a crystalline substance which, after sundry purifications, they convert into candles—said to be the most perfect and beautiful candles ever yet produced. The same kind

of il is being extracted from the peat bogs of Ireland. But paraffin is more profitably obtained, it is said, "by distillation of the celebrated Torbane Hill, or Boghead coal, and some of the Cannel coals, at a dull red heat; though even at this heat only a portion of the oil can be retained, the rest going off in the form of coal gas." An analysis of an average specimen of the coal is as follows, side by side with an analysis of the pure paraffin itself:—

BOGHEAD COAL.		PURE PARAFFIN.	
Carbon	60 to 65 per cent.	Carbon	84½ per cent.
Hydrogen	7½ to 9 ,,	Hydrogen	14¾ ,,
Earthy matter....	20 to 25 ,,	Loss, or oxygen.....	¾ ,,
	= 100 parts.		= 100 parts.

And by this distillation paraffin oil, naphtha, and pure paraffin are obtained. The oil, as before said, is used largely for machinery, the naphtha for light; so that a railway train may be driven by the coke, lubricated by the oil, and lighted by the naphtha obtained from the same hundredweight of coal. M. A. MOON, F.G.S.

[This series of papers on Coal are the substance of a Lecture delivered to an audience of working men, at Whitehaven; and are forwarded for publication in the Journal, in the hope that they may be of use for a similar purpose in other districts.]

MINING, A SOURCE OF WEALTH AND COMMERCIAL PROSPERITY.

"Mines, when successful, not merely enrich the adventurers, but the effect is felt far and wide, and the wealth of the country is thereby increased. The pursuit of Mining allures, fascinates, and enriches; it is a healthful recreation of the mental faculties to the mercantile or the professional; and it affords a refreshing equipoise to the groove of everyday business. A judicious investment of spare capital for a few months or years often produces a competency not attainable by other means in a lifetime. The grand results of Mining are its best advocates."—HUME.

SIR,—The effects produced on public credit, and especially so in respect to foreign countries, added to the warning of the Chancellor of the Exchequer to the "Money Market," to "take care of itself" in future, in case of commercial depression and collapse, as in the year 1866, has given rise to earnest discussion in well-informed circles as to the feasibility, far less probability, of suspending the "Bank Act" for a fourth time, should the Bank of England become placed in a dilemma similar to the catastrophe of Black Friday. It is true that a long period must elapse before companies and firms can attain the dimensions and power of Overend, Gurney, and Co., and the Messrs. Peto, still the position and engagements of the London joint-stock banks create no slight uneasiness in the minds of thinking men; for wherein can consist the benefits of past experience if the results of October, 1864, to the present day fail to enforce reflection and enhanced safety as to the future? The aggregate engagements of the nine London establishments, "deposits and acceptances," have attained the vast sum of 94,094,511*l.*, just "one full eighth part of the entire National Debt." It is stated by practical banking authorities, and the writer has been informed of the fact by an ex-Bank Manager, that it is a recognised admission in the executive administration of those establishments that 33 per cent. of the whole capital, deposits and obligations, are locked up in overdue bills, advances, with insolvent estates; yet they are computed and returned in the balance-sheets as of full value, and on no occasion or under any circumstance are they estimated at a reduced standard, until proved to be of *determined* or worthless assets. If this statement be correct, we must regard the sum of 31,364,837*l.* as permanently locked up out of the obligations of the nine London joint-stock banks, so long as the executive of those institutions continue their present system of business. Again, their balance-sheets must be inaccurate to the extent of the losses involved in realisation of securities—that is, composition under deeds of arrangements, voluntary releases, added to calamitous winding-up under bankruptcy. The cash in hand, at the Bank of England and at call, at the date of the last half-yearly returns was 15,425,296*l.*, just 16½ per cent. of the liabilities, under one moiety of the amount locked up in irregular and wholly unavailable securities—time and judicious realisation being indispensable to resist ruinous sacrifices.

Again, the total of Government stocks and securities, including debentures realisable, in addition to the cash before referred to, amounts to 12,832,482*l.*, or 13½ per cent., thus raising the convertible securities to 28,257,778*l.*, or simply together 30 per cent. of the whole commitments of the nine banks to their customers. Such a state of affairs may be sufficient in ordinary times, and possibly may be deemed satisfactory by the directors and managers in times of progress and unruffled prosperity, but in moments of feverish excitement, the character of the various liabilities constitute an important element, and it may require more than a well-selected bill case, maturing at successive dates, and over a period of six months, to meet the requirements demanded in times of emergencies. These bills are primarily the sources from whence the chief gains accrue, and contribute more than any other branch of joint-stock banking business to the large dividends periodically declared. Bills of exchange, however, are not always paid at maturity, and thus often involve risks fraught with disaster to all who are associated with them. The possession of these bills by the nine banks in question reduces them to mere trading and discount companies, hence they should be regarded by their respective proprietaries as simply speculative properties, instead of sound, stable, and unassailable banking institutions. Competitive trading is one thing, and *bona fide* banking is another—they stand as wide apart as the poles are asunder, and in our opinion whenever the next commercial panic arises the Bank of England will cripple the resources of the several joint-stock banks through taking in "money on deposit," similar to the latter, at 1 per cent. below the minimum rate of discount, rather than that the "Bank Act" should for a fourth time become suspended, in which case the Old Lady of Threadneedle-street will readily obtain the relief required; whilst as regards the joint-stock banks in question, the drain and pressure will become momentous and oppressive; and with "the thunder rolling louder and still louder," we question whether the electric shock will not involve a stringency of collapse far more severe and wide spread than the direful consequencies attending the false finance that culminated in the destruction of thousands in May, 1866. What we contend is that "joint-stock banks" are trading companies, and, in most cases, unquestionably most speculative and hazardous ones. Hence all associated therewith should look out for squalls in the distance, for sooner or later catastrophe will follow. The history of the past affords a salutary warning as regards the future, and the shareholder who becomes fascinated with present dividends without making provision for the future, though laying by one moiety of his earnings, is simply like the gambler at the "Roulette table," going wildly, or to say the least, blindly to ruin.

There is at present no question to be raised against the position that we are just emerging from—protracted distrust and inanity are attendant thereon, evidently showing that we are in that financial condition of recovery which points to some degree of active speculation, and which hitherto has been succeeded in due progress of time by prosperous periods of enterprise, and followed by feverish speculation and reckless gambling up to commercial pressure and ruinous panic with those too deeply committed. We have had what in America would be said a "fly" at Foreign Stocks, which for the moment is toned down to a degree inconsistent with the greed of the Stock Exchange; but the "fly" must go on, and will go on, in *something*, notwithstanding the caution of capitalists and the opposition of all the advocates of the monied classes and *drones*, who live on the industry of past generations in the contentment of 3½ up to 5 per cent. interest for their money. Let the squeamish investor place his money in Consols, India Stock, mortgages, or debentures—he may be both wise and useful in his generation, but such drones do not contribute to the progress of the nation, otherwise than allowing the enterprising the use of their capital; but they do not work to create real wealth, and must give way in the arena of action to the adventurous spirits of the age, who are incited to chances of gains through industry and competitive rivalry. These are the people who raised England to its unrivalled position, and not the "steady" class, who simply hold a grasp upon the breeches-pocket of the public, in the shape of taxing their labour and the fruits of their commercial and trading industry and progress. It is the adventure that creates vitality, and it is the adventurer who reaps the chief reward. The average of gains does not belong to the drone, but to the man of action, and this is apparent to a degree in the success ever attending "mining" pursuits, for who can point to such prizes as have attended mining industry and enterprise in any other branch of native or even foreign enterprise as we can instance in English mines, although in Australia, America, Brazil, California, New Zealand, Mexico, Chili, Cuba, Nevada, and the Cape, the success and prosperity of the people rest primarily with their mineral and metallic yield.

As regards our home mines, the men of action, and not the drones, secure success. It was the former who secured such prizes as the Devon Great Consols, Minera, East Caradon, South Caradon, Great Laxey, West Chiverton, the Van, Great Vor, and other mines, which startled whilst they fascinated the public. The drones, on the contrary, purchased the shares at immense premiums when the worth was thoroughly discounted on the market, hence the chief profits accrued to the "adventurer," whilst the "steady" man purchased to pay, in the shape of quarterly dividends, a fair rate for the use of his money. The latter never counts upon the risks he incurs, nor does he ever reflect upon the stability or continuance of his revenue—the dividends are substantial and satisfactory, so for the present he is satisfied; and as to the future, he risks the chances of success, and trusts to the chapter of events against loss or failure. Such characters may be correctly termed the drones of society, and very justly they encounter the heavy losses attending British mining investments. A reference to Devon Great Consols will establish the hypothesis, for the original shareholders, who gained above 1,000,000*l.* sterling in dividends in about 25 years upon their 1024*l.* expenditure, were *adventurers*, whilst the *drones* who purchased shares a year ago at 400*l.* can only now obtain about 150*l.* for their shares. The chief gains in "mining" are to be obtained from sound progressive undertakings, practically and effectively worked, and there are several now upon the *tapis* that can be purchased at comparatively ridiculous prices, when compared with their respective merits and chances of early and substantial success. These mines can easily be detected by practical authorities, and it is to such that we direct the attention of the uninitiated. A *fee of a guinea* can at all times secure a well-selected list of six mines, and it is incumbent on all to obtain correct data, statistics, intelligence, and opinions upon mining companies ere they embark capital, as it is often too late to retire and recoup themselves when they have parted with their money, by injudiciously investing it.

R. TREDINNICK, Consulting Engineer.

Crown Chambers, Crown-court, Threadneedle-street, June 21.

[For remainder of Original Correspondence, see this day's Journal.]

MINING IN INDIA.

We have received a communication from our old correspondent, Mr. GEORGE HENWOOD, dated May 8. We are sorry to learn that he has been suffering from a very severe attack of "Hill Diarrhœa," a complaint peculiar to and prevalent in the Himalayas; when of long duration it is fatal to Europeans. Mr. HENWOOD was obliged during the cold season to go down into the plains for recovery, where he was under the care of Dr. TUSON, formerly of the Fowey Consols and St. Blazey, for three months; since then he has been over the territory of the RAJAH of Simour and Nahun, a district in which iron and lead ores have been worked extensively in ancient days.

Our correspondent describes the iron lodes to be very large, and easily quarried. In some places the whole country has been denuded of wood to supply the furnaces; acres of cinders and slag, containing 50 per cent. of iron, attest the extent of the smelting works, which are of the most primitive description, the only endeavour of the natives being to save the pure iron at the bottom of the furnaces. This is the "wootz," or native iron, so much valued in India. Owing to the difficulty of conveyance, and the competition of English iron, these iron works have been discontinued, although in some districts wood abounds to an almost inexhaustible extent. He is of opinion they will be resumed, the RAJAH having established a foundry at Nahun, which promises to pay well, and to be developed into an extensive affair.

The lead mines in this territory are of very great antiquity. Mr. HENWOOD observes that the oldest portions appear to be the best and most judiciously mined; the more recent works being merely scratching at the surface, or burrowing like rabits, and filling the old well-driven levels with rubbish and refuse, without the slightest regard to ventilation or drainage. No works are made below the water level, for obvious reasons.

The lodes are in true killas, under conglomerate limestone. The mountain in which they exist rises to an elevation of 5000 to 6000 ft. The ores are very pure, and rich in silver, the native process of extraction, though of the most primitive character, yielding 70 to 75 per cent. of lead, and 14 ozs. of silver per ton of lead. The natives save none but the solid ore, any portions containing quartz, carbonate of iron, blende, or mundic, being consigned to the heap, which is annually washed away by the rising of a large river running at the mouth of the adit levels. The mode of smelting is much the same as that adopted for iron: hundreds of tons of lead slag lie at the surface, containing a large percentage of lead, and most probably of silver. After the ore is run into pig-lead it is taken (smuggled) to a city called Jaghadree, where it finds a ready market: it is here refined, by being converted into litharge, and the silver extracted. Mr. HENWOOD also visited this place, to see the process adopted, which he describes as the most simple possible, the only appliance that can be at all called mechanical being a small blower, or air machine (such as are used in Cornish mine levels), to create a blast! They use no bone-ash; their crucibles are merely basins, formed of a clay found in the jungle, but which is highly refractory: this substance, mixed with straw and cow-dung, forms pots, furnaces, and all the materials for the purpose. In the northern part of this territory there is another distinct series of lead mines, in which little has been done beyond discovering; the lodes, however, are very large, and the ores rich. The difficulty of approach and carriage presents a formidable obstacle to the mines being profitably wrought.

Among Mr. HENWOOD'S important discoveries might be mentioned that at this point he found beds or floors of semi-coal—not lignite, but imperfectly formed coal, having a crystalline structure, the upper series having much the appearance of "Black Bog." The substance burns slowly, gives out great heat, and leaves a reddish ash; but here, again, the cost of transit, he fears, presents an insuperable barrier to any successful result, except it be applied to smelting the lead of the mines close by; or in the manufacture of paraffin oil, for which a good demand exists all over India; and as the property is within five miles of the high road to Simla and to Umbralla, it is probable that it may be conveyed cheaply to Delhi and the cities of the plain by railway.

Mr. HENWOOD mentions that it is the intention of the spirited RAJAH to work the first-named series of lead mines at his own cost, when modern European appliances and direction will be brought into action. To show how very primitive the present uses are, he says—"For lights underground, instead of candles or oil, they use small slips of pitch pine or fir wood, a boy holding the lighted slip for the man to dig by. The ore they remove in skin bags, taking out about 20 lbs. at a time. Of course, they only select the heaviest portions." Mr. HENWOOD thinks there is ore enough broken and left in the levels to pay for clearing them out. To give some idea of the extent of the works he says—"I crawled on my elbows and knees for 100 fathoms, but could not force my way to the end." When the ore is raised, everyone who gets the mineral claims it to be his own, the RAJAH for some time having paid no attention to the matter, though at one period these mines are known to have been the source of a large revenue to former princes. With native jealousy, the miners secrete their treasure by burying it, sometimes in their barns, or under the floors of their houses, to prevent robberies by unscrupulous Jemindors, who claim all on account of his Highness, though he never receives a rupee from these gentry.

In this excursion Mr. HENWOOD passed through many villages in which no white man had been before seen; others in which the only European visitors had been the Government Survey officers. This remote district is at the foot or first series of the Snowy Range. He describes a snow-ball match by the Indians as a curious sight. In his journey he was accompanied by the manager of his Highness's iron works at Nahun. We believe it is Mr. HENWOOD'S intention to publish his "Journal" in detail in our colomns on his return, when we doubt not our readers will be presented with many an interesting, and to some instructive, anecdote or geological fact.

With respect to the mines Mr. HENWOOD was engaged to go out to India to report on and to open out, he says—"We have four or five mines discovered, and proved to be productive; but I advise you at present to apply all your energies to one or two only. These may be made dividend paying in a short time; the rest can be resumed at any time. You have discoveries enough to last for a century." At one level on a lode discovered by him, and thence called "HENWOOD'S Lode," they have a lode 6 ft. wide, of nearly solid lead ore. From this level alone they now raise about 15 to 20 tons per week. In a short time two other levels will be opened out on this lode at greater depths, and the returns correspondingly increased. At this mine, the "Subbathoe," they have also another lode, 1 ft. wide solid lead ore, on which levels are being driven.

Extensive smelting furnaces have arrived out at Calcutta, a new water-wheel, &c., one being put up; so that ere long this company will be in full operation, and we trust success will attend on deserving and enterprising endeavours.

Mr. HENWOOD'S engagement for two years, we believe, is nearly expired, but he does not say whether he returns or remains; that will, most probably depend on the state of his health.

SLATE QUARRYING IN WESTPHALIA.

With a view to meet the continually increasing demand for slates in Germany, an effort is about to be made for obtaining additional capital in this country for the extension of the BERLEBURG SLATE QUARRIES, in Siegen, Westphalia, which comprise a very valuable concession, extending over four square leagues, situate in the principality of Wittgenstein. Considerable importance attaches to the property, from the circumstance of its being regarded as the only district in all Germany where beds of slate are found in such abundance, of equal thickness, and of a quality which can bear comparison with the first slates of North Wales. The company was originally formed with a capital of 30,000*l.* (200,000 thalers), which has been expended in the opening of one quarry, and the construction of a suitable railway and sawing machines, an additional 15,000*l.* being required for completing the works, and placing them in a profitably productive position. The quarry already opened forms one of seven concessions owned by the company, and lies on the incline of a hill some 300 ft. high, in such a manner that it can be easily worked without any tunnelling, and open to the day. This quarry has been opened over an extent of 400 ft. long, and about 150 ft. in height, in which five stages or open galleries have been established, each story being 30 ft. high and 50 ft. wide, and cut into solid slate-rock of the finest quality and colour. There is still space for two additional galleries to reach the summit of the hill, which will give about 200 ft. in height of slate-rock.

From the summit of the hill to the base the different galleries are connected with each other by a railway, which brings the blocks direct to the building where the machinery for sawing and cutting has been erected. The sawing and cutting machinery has been imported from England, and are of the most approved patterns used in North Wales. The extent of the concessions is so great, and the slate is found in such abundance, that an ample supply may be relied upon for centuries. The present establishment is equal to about 5000 tons of slate per annum, but with the additional capital which it is now proposed to raise that quantity could easily be doubled or trebled. Taking an annual production of 10,000 tons, it is estimated there would be a profit of rather more than 1*l.* per ton (the selling price being about 38s., and the cost of production nearly 18s. per ton), which would give a net profit of about 23 per cent. upon the entire amount of 45,000*l.*, of which the company's capital will consist. It is proposed to raise the new capital by first mortgage bonds upon the entire concessions, lands, buildings, and all machinery and plant, such bonds bearing interest at 6 per cent., and being entitled to 10 per cent. of the net profits of the company; or else by the formation of a new company for purchasing, entirely with paid-up shares, the present proprietors' interests. The Bergisch-Markisch Railway Company have commenced their line from Alten Hunde to Marzburg, which will pass close by the Berleburg Quarries; this will materially diminish the cost of transport (hitherto paid by the consumer), and doubtless give an increased impetus to the demand for the company's slates.

SEPARATING SILVER FROM LEAD, &c.

BY A. GIRAUD.

In my improvements in Separating Silver from Argentiferous Lead, in Purifying Lead, and in the necessary apparatus, I commence with extracting as completely as possible by any of the ordinary methods the antimony which may be contained in the lead. Immediately afterwards I place the lead in any suitable vessel, but by preference I employ for this purpose a melting pan (hereinafter called boiler), to which I adapt an opening at its base in order to allow the fused metal to be run off as required. This melting pan or boiler may be set on an ordinary furnace, but by preference the furnace should be provided with a movable grate, which will facilitate the instantaneous extinction of the fire.

For greater clearness in my description I shall divide my boilers, composing each range into the following order, that is to say:—First boiler containing the argentiferous lead freed from antimony; second boiler reserved for the rich litharge or dross; and third boiler for the extra rich skimmings of the litharge or dross. Although I here mention three boilers for the purpose of exemplifying my process, I do not limit myself to that number. I light up the furnace of the first boiler, and when the lead therein is reduced to a perfect state of fusion I increase the intensity of the fire, and then I add to the fused metal a sufficient quantity of zinc, the proportion varying according to the richness of the lead, previously ascertained by assay. I immerse the zinc by means of an apparatus next herein after described, and which I call a "mixer." This apparatus consists of a box or case divided into two parts, united by bolts or otherwise. The box or case is perforated and attached to a metallic spindle, provided with radiating branches or paddles to promote the mixture of the zinc with the fused metal. But I do not confine the arrangement of vanes or paddles to the simple disposition of projecting or horizontal arms or branches; any system of horizontal or vertical vanes or paddles working from or in combination with the spindle and box may be employed, as well as any variation in the arrangement of the box or case attached to the spindle. The spindle, with the box attached containing the zinc, is adequately sunk in the molten metal, and supported at the top end by one or more riding bars set on the rim of the boiler, or by any other method of vertical suspension. Thereupon a revolving motion is communicated to it, and the zinc fusing and escaping from the box in small particles passes through the mass of lead in agitation, and arrives insensibly at the surface, drawing with it a great part of the silver. When the mixture of the zinc with the lead is terminated the "mixer" is withdrawn, and the fire suddenly extinguished, continuing for some time longer to stir the molten metal. It is then necessary to watch the metal and take advantage of the favourable moment for lightly and dextrously skimming the surface, taking care to remove as little as possible of the lead. The produce of this skimming, which is called argentiferous dross or rich litharge, is thrown into the second boiler in order to be there treated separately, which will be the subject of subsequent description. The fire of the first boiler is now re-kindled for the purpose of re-melting the metal therein contained. The "mixer" is introduced a second time charged with zinc, and the operation above described is repeated exactly in the same way until it is ascertained by assay that the silver has been entirely extracted. Commonly after two such operations a third will be needless, inasmuch as the precious metal will be altogether, or almost entirely, extracted from the lead. The purification of the lead is then to be effected, so that it may be freed not only from the zinc, but even from other foreign matters. For that purpose a brisk fire is re-kindled under the first boiler, which is hermetically closed by the aid of a cap or cover, which I prefer should be somewhat convex, and securely fastened to the rim of the boiler by keys or otherwise. In the cover two apertures should be contrived, one for the passage of a pipe leading steam into the metal in fusion, and the other larger for the escape of the steam, carrying with it a great quantity of oxide of zinc and other matters. To this second opening is adapted an external tube communicating with a condensing chamber or receptacle, and conveying thither the oxide of zinc and other matters. This chamber should be divided into several compartments and conveniently ventilated. The steam pipe is sunk in the molten metal to such a depth that the steam may spread throughout the mass of metal. If the boiler be very large, and one jet of steam insufficient to reach the zinc in every part, the principal pipe may be fitted with several auxiliary pipes, which will permit the steam to penetrate quite through the molten lead. The higher the temperature of the steam the more prompt and efficacious will be its effect. It will be prudent to adapt to the steam pipe externally two taps, one for regulating the admission of steam into the metal, the other to be first opened to let off any water collected in the pipe, which will prevent any spattering of the fused metal. I do not restrict myself to the use of taps; any other available means of regulating the passage of the steam, and for drawing off the moisture and precluding condensation, may be employed. When the steam shall have been introduced into the molten lead it will be desirable to ascertain when the oxidation is completely terminated. To that end a valve or tap, or other contrivance of the kind with any suitable appliances, is fitted to the escape tube to permit of seeing whether the steam passes in its natural state clear of oxides or other matter, and then its function being terminated the steam is suppressed. The cover with its appliances is then removed, and all the oxides and other matters which float on the surface are very lightly skimmed off, carefully avoiding the metal as much as possible. Now that the lead is entirely purified it is poured in the usual way, or run out into moulds in the shape of pigs or ingots, or otherwise. If the latter operation be employed the conduit by which the lead is run off should be heated by an appliance in the nature of a chafing dish or brazier, or otherwise, for the purpose of preventing premature cooling. For conveyance of the moulds and in order to expedite that operation I employ by preference, but not exclusively, a rail or tramway with appliances for transmission, which I call port moulds, or little trucks. When by the preceding operations several times repeated I have obtained a sufficient quantity of argentiferous dross or rich litharge to fill my second

boiler, I proceed then to treat it in the following manner :—Those rich skimmings or dross, composed principally of lead, silver, and zinc, should be reduced to fusion in order to receive the steam, with a view to oxidise and remove the zinc and other matters. When this is effected the metal remaining may be refined by cupellation immediately afterwards, inasmuch as it would contain considerably less lead than after the usual Pattinson process ; but it is preferable to treat it as next herein after explained.

I light up the furnace under the second boiler containing the rich litharge, and when the contents are in perfect fusion I introduce a "mixer" without a box, but provided with radiating vanes or paddles, suspended and worked in the same manner as the "mixer" first described, in order to amalgamate the lead, silver, and zinc which compose the contents of the boiler. I then extinguish the fire, and I continue to skim as long as possible all that coagulates on the surface, carefully casting into the third boiler this new litharge, which I call "extra rich." If the lead, or rather the litharge or dross, that remains in the second boiler still contain a certain quantity of silver, I bring it again to a state of fusion. I introduce this time a "mixer" having a perforated box attached, with a small quantity of zinc in proportion to the requirements, and I effect a complete mixture as herein before described. Then I draw the furnace and I again skim the coagulated surface, of which the skimming is to be taken to the third boiler. If the metal, or rather the litharge or dross, that remains in the second boiler contain still a quantity of silver nearly equal to that of the primitive silver-lead, more or less, it may be mixed up with other metal prepared to undergo treatment in the first boiler, as herein before described. In case however it is much richer than the primitive silver-lead it is better to melt it again in the second boiler, and repeat the last preceding operation with a "mixer," and box for the addition of the adequate proportion of zinc. Often after the last operation the lead remaining in this second boiler contains a very small and nearly insignificant portion of silver, so small in fact that it may be disregarded. Then the contents of this boiler is re-heated to fusion with a brisk fire, and the lead is purified by the aid of one or more jets of steam, cleared of oxide, and skimmed, and the remaining metal is subsequently poured or run into moulds. As to the extra rich litharge or dross placed in the third boiler, when a sufficient quantity is collected it is reduced to a perfect state of fusion, and with the application of steam in a manner similar to that herein before described it is freed from the zinc and other matters. Immediately after this operation the product may be taken to the cupel furnace, or otherwise disposed of, for the purpose of obtaining the silver in a state of purity by any approved method. By continuing these operations, employing small pots, by preference somewhat of the form of crucibles, and with the modifications in manipulation self-evident to a skilful workman, the silver may be freed from alloy or impurities, so that it may remain in a state of purity, or nearly so. When a sufficient quantity of oxide and other matters of a nature to be converted to useful purposes is collected, suitable means are adopted to utilise the same.

Meetings of Public Companies.

ST. JOHN DEL REY MINING COMPANY (LIMITED).

The thirty-ninth annual general meeting of shareholders was held at the London Tavern, on Wednesday,

Mr. JOHN HOCKIN (managing director) in the chair.

The notice convening the meeting was read, and the report of the directors (which appeared in last week's Journal) was taken as read.

The CHAIRMAN said—The report which we now present to you, and which, as it has been in your hands a week, you have had an opportunity of carefully considering, has not, we trust, all circumstances considered, been deemed wholly unsatisfactory. A very large establishment, situated many thousand miles from this country, the seat of its management, existing under very peculiar circumstances as regards its supplies of labour, materials, and provisions, all of which had to be contracted for much in advance, was suddenly brought almost to a standstill, as far as its remunerative element was concerned. The main deposits of ore were buried under heaps of debris too vast to admit of its being passed through. Other and comparatively unimportant deposits, both in size and quality, had to be sought, and arrangements, all involving outlay, had to be made for working them. The large force of Europeans and natives, the majority of whom were under contract for longer or shorter periods, had to be reviewed and reorganised. The contracts with the Europeans involve sending them to this country, another source of unremunerative expense. Large quantities of material sent from this country, and involving heavy outlay for duties and inland carriage, and still larger quantities contracted for in Brazil, had to be taken and paid for, though not immediately required. These unforseen circumstances, both as regards absence of supply of good ore and a forced unnecessarily large supply of labour and materials, have been met by a net loss to the company for the last 18 months of the comparatively small sum of 15,600*l.*—the sum standing to the debit of profit and loss—which includes all charges both in this country and Brazil, except the income tax now due. To make this statement complete, however, I must add that the value of the stores on the mines at the close of the account in February last exceeds their value at the commencement of the 18 months now under consideration by 9500*l.*, so that the actual loss the company has sustained in property during the 18 months is only 7000*l.*, including the income tax now payable. In this statement I do not include the expenses incurred in sinking the new shafts for reaching the lodes known to exist, and to be of great value. This amounts to 3319*l.*, and, as you are aware, is carried to a separate account. This, then, is your position as to capital and property. Valuing your stock of stores at the beginning and close of the 18 months ending in February last, and balancing your receipts and expenditure for the same period abroad, and up to May 31 in this country, and including 1100*l.* income tax on profits in 1867 now payable, there has been a loss of 7000*l.*, and a further sum of 3319*l.* has been laid out on the work in hand for recovering the mines. This, I think, you will agree with me in thinking is a result more favourable than might have been anticipated. Turning next to finance, you will have seen that though, as I have said, the stock of stores has been increased, and there has been a loss of the sum of 7000*l.*, yet we have been able, in consequence of the monthly expenditure having been so considerably reduced, to reduce our balances at Morro Velho and at Rio Janeiro, and thus have not required to use any portion of the reserved fund to meet the general expenditure, either at Morro Velho or on the Fernam Paes estate. The uninvested interest of the reserved fund (2418*l.*) has been temporarily applied to meet in part the expenditure on the new shafts (3319*l.*) The balance now due from the reserved fund account to the new shafts account (up to February 900*l.*), the sums expended since—March and April—(1897*l.*), with the amount that will be required for the next few months, altogether about 5000*l.*, we propose to draw from the reserved fund at once. This sum, with the proceeds of the gold due ten days hence, will keep us in ample funds until the arrival of the gold in September, and we do not anticipate having to draw on the reserved fund during the next six months, other than for the new shafts expenses. I have now stated what the results of the operations at the mines have been up to the end of February, the close of the financial year, as given in the report. We have since received the returns for the two following months. The working account of cost and produce for these two months show still, I am sorry to say, some loss, but the London account of expenditure and produce, which affects finance, will not show much loss. The accounts received on Monday, which I think are in your hands, are so far satisfactory that the cost for April is the lowest on record for many years, and the produce for the last 20 days of the period reported on is larger than for any similar period since May, 1868 ; indeed, the produce for the two last divisions of April, and the first division of May, covers the cost. The yield of the mineral had also improved ; for April it was 2·094 oits. per ton, being the highest yield since June, 1868 ; and for the first division of May it was 2·169 oits. per ton (not including the arrastres and Praia), against 1·444 oits. per ton, the average for 1868. This is an improvement of ¾ oit. per ton. Writing on this subject, by the mail just arrived, Mr. Gordon states :—"This is the best produce we have extracted for some months, and, if it continues at this rate of yield, would entirely cover our working cost, even at the reduced rate of duty the stamps are now doing" (referring to the short supply of water during the then dry season). And Mr. Gordon goes on to say—"It will be satisfactory if this amount of gold return can be obtained now with regularity. There is no reason to doubt this can be done, unless some unexpected interruption should arise to interfere with the operations now being carried on." In regard to the new shafts, you are told in the report (page 6) that the whole of the surface arrangements had been completed for drawing with horse-whims, and that the shafts had been carried down through rather unfavourable upper strata to firm ground. The rate of sinking through the former had been only 3 fms. 2 ft. per month, but I am happy to say that Mr. Gordon writes by the last mail that the rate had been increased. During the first 16 days of May the rate had been 11 ft. 9 in. in one shaft, and 14 ft. 6 in. in another, being an average of over 4 fms. a month in each shaft. Mr. Gordon adds—"This month will, I have reason to expect, show the best sinking we have had yet in these shafts. Both miners and captain are working very earnestly and zealously." In regard to the Fernam Paes Estate, though we have been shut out from the best part of the formation at the Gaia for the last six months, there has been, notwithstanding, a net profit of 878*l.* during the year. On this estate there are two formations from which mineral is now being quarried—the Gaia, contiguous to the stamping-mill, and the Gabiroba, which is 2½ miles distant. At the Gaia, as I have said, we are at present unable to get at what is considered the best part of the formation, though it is hoped that that inconvenience will not be of much longer duration. The Gabiroba lode is of a richer and more promising character, but the distance from which the ore has to be brought considerably increases the cost. If on this lode being a little more opened out it realises the expectations entertained as to its size and value, inexpensive means may, probably, be found for its transport to the Gaia mill, as well as for raising the mineral and water. I may mention, however, that though this property has not as yet proved profitable, it is at this moment a great advantage to the company to possess it, as affording a means of maintaining and keeping together at no expense a portion of our force, which might otherwise have to be dispersed. The expenses have been reduced fully one-half during the year, the principal items of reduction having been in labour, 29,000*l.* (that is, from 65,000*l.* to 36,000*l.*) ; in provisions and materials, 15,000*l.* ; in stores shipped, which were *nil*, as against 6000*l.* ; duties at Rio and carriage of stores had also been reduced 3500*l.* ; and the commissions at Rio and charges on gold had been reduced about one-half. As I have already said, the total expenses had been reduced about one-half as compared with the preceding year, which I think is satisfactory, seeing that we have operated upon nearly as much mineral. It shows that the establishment has been more economically managed. I will now move that the report and balance-sheet be received and adopted.

Mr. LEVANCHY enquired if Mr. Sopwith had returned to England ?—The CHAIRMAN replied in the affirmative, and stated that the abstract of his report was embodied in that of the directors. As to the cost of the two shafts, he might mention that up to the present time Mr. Sopwith's estimate had not been exceeded.

A SHAREHOLDER asked as to the time it would take to complete them ?—The CHAIRMAN said the last few fathoms had been sunk at the rate of 4 fms. per month, and at that rate it would take about three years to complete the shafts to the required depth.

A SHAREHOLDER asked if it were in contemplation to employ any of the improved machinery to facilitate the operations ?—The CHAIRMAN said he did not see his way, at any rate for the present, to apply any of the newly-invented boring-machines. He mentioned last year that a trial of one of those machines was about to be made at a slate quarry in Wales with which he was connected, and that he hoped it would go to work in March. The machine was got to the works at the time, when it was found that the turbine was not of sufficient power, and they were now waiting for another turbine. Suppose they had sent out one of those machines to Brazil, the same difficulty would have occasioned a delay of at least six months, to say nothing of the cost. He looked, however, for some important result from the use of the new blasting-powder—dynamite—as soon as it could be got to the mines. Six months since he ordered ½ ton, and from that time to the present he had been unable to get it on board ship, and simply because those connected with the manufacture and sale of gunpowder were endeavouring to prevent its being used. At length, however, he had succeeded in getting it shipped on board a vessel, which would leave for Brazil on that or the next day.

Mr. JAGO said they were much indebted to their Chairman for the way in which he had persevered with regard to this matter, and he (Mr. Jago) believed that it would prove of immense advantage, accelerating the sinking of the shafts.

The report was received and adopted unanimously.

The retiring director and auditors were re-elected, and the directors were authorised to draw such portions of the reserve fund as from time to time the necessities of the mine may require.

The CHAIRMAN explained that 2800*l.* had been expended upon the new shafts account, and that the expenditure during the next four months would probably be 3000*l.*, so that the outlay during the half-year would be something like 6000*l.* The directors now proposed to realise 5000*l.* of the reserve fund by the sale of Consols. By the Articles the board possessed the power to raise any sum of money not exceeding the total amount of reserve fund ; but if they borrowed they would have to pay 5 per cent., whereas if they sell Consols they would only lose 3 per cent. (Hear, hear.)

A SHAREHOLDER asked if the enquiry was being continued into the cause of the disastrous fire at the mines ?—The CHAIRMAN said the board thought the best means of eliciting the truth was to apply to the local authorities, who had power to hold legal courts and make legal enquiries. The head of the police, next in authority to the President, went over to the mines as soon as possible, but the President requested his return, to discharge duties more immediately important, so that the enquiry was not completed.

Mr. SPENCER HERAPATH had much pleasure in proposing that the best thanks of the meeting be given to their Chairman, for the manner in which he had presided upon the present occasion. The able way in which he had filled the chair and the clear and explicit character of the information he had submitted, must at once commend itself to all business men. (Hear, hear.)

Mr. LEVANCHY had much pleasure in seconding the motion. He believed they had to thank their present Chairman for having brought their affairs into such a condition that reflected credit upon himself as well as upon the company.

The motion was put and carried unanimously.

The CHAIRMAN thanked the shareholders for this renewed mark of their confidence, and stated that it had been his endeavour for 17 years to perform his duties honestly and faithfully, and he need hardly say that he would continue to do so to the best of his ability. (Hear, hear.)—The meeting then separated.

GONNESA MINING COMPANY.

The annual general meeting of shareholders was held at the offices of the company, Queen-street-place, on Wednesday,

Mr. HENTY in the chair.

The report of the directors stated that the profit on the operations of the 12 months ending July 31, 1868, amounted to the sum of 7550*l.* 12*s.* 8*d.* The returns of lead ore during the year embraced by the accounts had shown a diminution when compared with those of the previous 12 months, and this had arisen chiefly from the sudden impoverishment of one of our principal lead mines (San Giovanni), but the engine-shaft had nearly reached the depth required for another level in this mine, and there was good reason to expect an improvement in the lode at that depth. Much interruption had been met with in working the deposits of zinc ore (calamine) by the excessive and long-continued wet weather of the past winter, and by various circumstances, of which details were given, but there were features in the whole enterprise, especially the important discoveries of calamine, which were of the most encouraging character, and every confidence was felt that the company is destined ere long to enter upon a very prosperous career. By the Articles of Association the board has power to borrow to the extent of 15,000*l.*, and it might be found advisable to exercise this power in face of the greatly extended scale of operations, and of the objections attaching to the employment of the profits as working capital.

The CHAIRMAN, in moving the adoption of the report and accounts, alluded to some of their leading features, and invited the shareholders present to notice any matters upon which they might desire further explanation.

Mr. E. H. GALSWORTHY asked several questions in reference to the report, and accounts.—Mr. RICHARD TAYLOR replied at length, and in the course of his remarks gave much interesting information, acquired during his recent visit to the company's property in Sardinia.

Mr. GALSWORTHY having expressed himself to be much gratified by Mr. R. Taylor's reply to his enquiries, the report and accounts were unanimously adopted, and the retiring directors and auditor re-elected.

A vote of thanks to the Chairman and directors closed the proceedings.

[For remainder of Meetings see to-day's Journal.]

FOREIGN MINING AND METALLURGY.

Deliveries of Belgian coal by water have somewhat increased during the last few days, in consequence of the approach of the usual closing of the navigations. The deliveries made by railway have been also considerable, and the amount of plant placed at the disposal of coalowners seems more abundant than in former years. The Belgian iron trade is a little quieter, perhaps ; but the proprietors of the blast-furnaces have exhausted their stocks, and the daily production will readily and easily find outlets. The orders on the books of the ironmasters for rails, rolled iron, and plates assure also a continuous amount of work for the whole of the rest of the year. The state of the Belgian construction workshops is, however, not very prosperous. These establishments have orders on hand for fixed engines of every kind, but for Belgium only, to a great extent, as it is difficult for them to obtain foreign orders, in consequence of the import duties with which they have to contend. Thus the Belgian establishments specially devoted to the manufacture of locomotives do not obtain, notwithstanding all their efforts, orders in Germany, transport expenses and Customs duties having an absolutely prohibitory effect. The Belgian blast-furnaces having exhausted their stocks, there is a tendency to increased production, especially in the Liége basin, where preparations are being made for the re-lighting some furnaces. It remains to be seen whether this is not a premature movement. The Thy-le-Château Blast-Furnaces and Forges Company will pay, July 1, a dividend for 1868 at the rate of 10 per cent. per annum. The Herve-Wergifosse Collieries Company will also pay, July 1, a dividend for 1868 at the rate of 2*l.* 8*s.* per share.

A great deal of activity prevails at present in all the French works, and the movement of affairs appears to be steadily becoming more important. In the Haute-Marne coke-made iron has been in great demand, while puddled iron from charcoal-made pig has been rather quieter. For sheets and iron wire considerable orders have been received. It is proposed to establish a rolling-mill at Marnaval ; the promoters have made their calculations with a view to the production of 500 to 600 tons per month. The works of the Moselle have little or no stocks on hand ; the blast-furnaces and rolling-mills would thus seem to find it rather difficult to execute the orders which they receive, as well on French as on German and Swiss account. Some considerable contracts for refining pig are understood to have been concluded by southern firms at 2*l.* 16*s.* per ton, in warehouse at the works. MM. de Wendel and Sons are making extensive changes in their works. Thus they are now constructing two blast-furnaces, 80 ft. in height ; thirty puddling-furnaces, for the employment of the Siemens process ; and workshops for the production of forgings, marine plant, &c. The foundries of the Ardennes are much occupied in consequence of contracts concluded with Parisian firms ; first fusion pig has, consequently become scarce and dear. It is stated that an Ardennes establishment has discovered a new process for the production of pipes. The Graissessac Mines Company have been paying since the 15th inst. a dividend on account in respect to 1868 ; this dividend is 8*s.* 10*d.* per share. The Chatillon and Commentry Forges Company has been paying this week the dividend for 1868, or 1*l.* per share. The accounts of this latter company for 1868 show a net profit of 37,676*l.*, to which must be added 241*l.* brought forward from 1867, making a total of 37,917*l.* available for dividend. Of this sum the dividend of 1*l.* per share now being paid will absorb 25,000*l.*, 12,000*l.* will be devoted to the statutory reserve, and 917*l.* will be carried forward to the credit of 1869.

Parties engaged in the coal trade may, perhaps, learn with some interest that there is now no probability of the Suez Canal being ready for service before December, 1869, or January, 1870. It is possible enough that to save appearances, M. de Lesseps may get up some fêtes in October by way of preliminary inauguration, but large vessels cannot pass through the canal before the dates indicated. Thus the whole amount of earth to be extracted from the canal works is officially estimated at 75,921,270 cubic metres, and in the month ending May 15—the last date to which we have precise information—the extraction effected amounted to 1,704,075 cubic metres. The aggregate extraction to May 15 was thus increased to 63,402,303 cubic metres, leaving 12,518,967 cubic metres still to be extracted. At the rate of extraction which prevailed in May the work would not, then, be completed until the lapse of 7¼ months as from May 15, which would carry working operations on as nearly as possible to the close of 1869. It is important to note that it does not seem probable that the process of extraction can be much accelerated, as out of 60 dredgers owned by the company no fewer than 58 were in operation May 15. With great exertions, and with no adverse circumstances to occasion delay, M. de Lesseps may succeed in getting ships of heavy draught through the canal by Jan. 1, 1870, but not a day sooner. However, it must be admitted that he has worked with the heart of a lion, and that there is something wonderful in the progress which he has thus far achieved.

The demand for rails appears to be assured for some time to come on the Continent by the activity which still prevails in connection with the work of railway construction, more especially as regards France, Russia, Austria, and Hungary. In 1856 France possessed 3875 miles of railway, and Russia seems now to have about the same extent of iron way. The Russian Government will probably next extend its solicitude to the establishment of railways in the West of Russia, so as to unite the interior of the country to its military positions on the Vistula. In the second place the Russian Government will apply itself to the extension of railways towards the Black Sea ; and, finally, it will occupy itself with the establishment of lines in the Caucasus and in Siberia.

Copper has been firmer at Havre, and has displayed an upward tendency without, however, any very large transactions having taken place. Chilian in bars has changed hands at 69*l.* 8*s.* per ton, Paris conditions, deliveries to be made at the close of the current month ; for deliveries to be made in the second fortnight of June 70*l.* per ton has been obtained. The Paris copper market has presented a favourable tone ; Chilian in bars has made 70*l.* ; ditto in ingots, 74*l.* ; and Corocoro minerals, 72*l.* per ton. At Marseilles, Toka in warehouse has risen 1*l.* per ton (to 74*l.*) ; refined Chilian and Peruvian for consumption have brought 76*l.* per ton. The German copper markets have been quiet, but previous rates have been maintained. At Paris there has not been much variation in the price of tin, but, on the other hand, there has not been much business doing in the article. At Marseilles, also, there has been no change in tin. There has been some feebleness observable in tin upon some of the German markets ; on the other hand, at Stettin there has been somewhat more firmness. The Rotterdam tin market has been very inactive ; some hundreds of ingots of Banca have changed hands at 81 fl., at which price there were sellers at the last dates. There had been some rather considerable deliveries of Billiton, which had rather depressed the market ; some lots had found purchasers at 79 fl., and more recently transactions had taken place at 78¼ fl. The last mail from the Dutch Indies gave the following returns as to the stock of Banca at the end of March :—At Banca, 180,454 ingots ; at Java, 74,526 ingots ; total, 254,980 ingots. The Amsterdam tin market has been extremely quiet, and the transactions which have taken place have been of little importance ; prices of Banca have slightly given way. In Billiton a few transactions have taken place at Amsterdam at 78½ fl. Lead has generally maintained former rates, but without any very considerable transactions having taken place. There is not much change to notice in zinc as regards the French markets, but on the German markets the article has been firmer.

FOREIGN MINES.

ST. JOHN DEL REY.—Morro Velho, May 17 : Morro Velho produce for April, 9939 oits., from 4745 tons ore ; yield 2·094 oits. per ton. Morro Velho cost for April, 4356*l.* ; loss for ditto, 513*l.* Morro Velho produce, 11 days of May, 3394 oits. ; yield 2·169 oits. per ton. Gaia produce for April, 1212 oits., from 946 tons ore ; yield 1·281 oits. per ton. Gaia cost for April, 445*l.* ; Gaia profit for ditto, 73*l.* Gaia produce, 11 days of May, 421 oits. ; yield 1·253 oit avas per ton.

DON PEDRO.—Mr. F. S. Symons reports for April—Produce and Cost : Produce, 20,218 cits., at 8*s.* 6*d.* per oit., 8592*l.* ; cost, 3294*l.* ; profit, 5298*l.* The heavy sick list and general unhealthy state of the force have militated against us, yet we are enabled to show a first-rate produce and corresponding profit, again testifying to the richness of the lode. Sinking has progressed, and progress made to Vivian's shaft, so that in as short a time as possible machinery will take the place of manual labour in transporting ore to the tram levels. The cost for April was affected by heavy amounts paid for timber, capitation tax, and gold troop expenses. Health of establishment at present more favourable.

ANGLO-BRAZILIAN.—Mr. F. S. Symons reports for April—Produce and Cost : Produce, 2441 oits., at 9*s.*, 1098*l.* ; cost, 1596*l.* ; loss, 498*l.* The cost would have been much more favourable had it not been affected by the heavy capitation tax paid on force to the general and provincial Governments. The operations have been carried on with regularity, and a satisfactory amount of work accomplished both in and out of the mine. The gold return exceeds that for last month by 217 oits., and the standard of the stone treated shows a trifling improvement. At Foster's west the auriferous quality of the stone has materially improved, and its appearance is all that could be desired ; this being our nearest point to the Fundao section we hope that the lode encountered is connected with the reputedly rich Fundao lodes. At the deep adit the lode is increasing in size, and assuming the features of that at Foster's east, but it is becoming a little disordered in the centre. The sinking of the shafts is being prosecuted with all the means at our command.—First Division of May—Extract, dated May 17 : Foster's section maintains its favourable features, and a branch of good lode of increasing size is making its appearance at Haymen's. Dawson's presents no alteration. We have not yet got through the mass of killas that played so much havoc with the good lode we formerly had here and in the canoa. From Foster's we shall work on the Fundao lodes. This section is our most productive one, and highly promising in appearance, and the Vicera yet remains to be encountered, which, if any reliance can be placed on reports, will compensate for past misfortune.

GENERAL BRAZILIAN.—Messrs. John Moore and Co., the company's agents, advise, under date May 22, that they were that day in receipt of the further title deeds and other documents which had been sent down by Capt. Treloar at their request, and that the same had been placed in their lawyers' hands for examination. The agents further advise that they had obtained the Government grant for working the mine, and that the decree had duly appeared in the Diario Official, a copy of which we enclose, duly certified by the British Consul.

ROSSA GRANDE.—Mr. E. Hilcke reports for April—The produce amounts to 1505 oits. of gold. The general operations have been carried on steadily.—Gongo Mine : The monthly produce derived from the old mine and surface amounts to 215 oits.—Mina de Serra : In the beginning of the month we resumed our operations at the 50 ; we found the lode at the eastern part of a good productive quality, its size varying from 2 to 4 ft. Stopes have been opened about the 40 east on a similar yielding lode as that at the 50, but of a more bunchy nature. Our supply of stone for the stamps during the month has been derived from these two places, and gave an average percentage of 8 oits.—Bahu Mine : The lode discovered at the bottom of the old workings at the eastern part of the main mine has been closely examined, and gave the satisfactory result of 8·3 oits. of gold per ton ; the size of the lode is at its present depth very small and bunchy, but credible persons who have known the main mine when open assured me that the lode is of larger size and superior quality in depth.—First Division of May—Extract, dated May : At Gongo Mine the communication between the two shafts will, I hope, be completed in a few days. At Mina de Serra and all other points of operation no particular changes have occurred.

TAQUARIL.—Messrs. John Moore and Co., of Rio, the agents of this company, under date May 22 announce the following :—Government Grant : We have the pleasure to inform you that this decree was published this morning in the Diario Official.

IMPERIAL SILVER QUARRIES.—Lewis Chalmers, May 31 : Fifteen feet of tunnel were made last week.

PESTARENA.—Thomas Roberts, June 16 : In the winze sinking from the bottom of boundary stopes we cut into the wall mentioned in our report of the 2d, and found it to be a lode that formed a junction with the lode on which the winze is being sunk ; both appear to be taking down together. We estimate the winze to yield now 2 tons of ore per fathom, worth on an average 1 oz. of gold per ton. From a trial of some picked ore from this winze with six small mills we obtained after the rate of 2 ozs. 6 dwts. per ton. Seeing this rich quality ore, we have strong faith for a further improvement in this winze. We expect another junction in 16 metres more sinking.—Aquavite : The end of the 33 south yields 7 tons of 1 oz. ore per fathom. The new stope in back, behind this end, 5 tons per fathom, worth 1½ oz. per ton. We have resumed stoping in the bottom of the 46, on the course of ore. No change in the ends and other stopes not mentioned.—Peschiera : In the stopes in bottom of the 70 we have a slight improvement on the upper part of it.—Val Toppa : In driving north at Marmo Rosso level we have a strong lode coming in the end. The weather is unseasonable—wind and rain.

MONSTER STEAM-BOILER.—Some excitement was caused at the Netherton Station on Thursday by the arrival and conveyance of an immense steam-boiler from the station to the works of Erskine Beveridge and Co. St. Leonard's. The boiler, which could not weigh less than from 14 to 16 tons, was secured on a strong lorry, drawn by powerful horses. A fair start was made from the station, but the horses had not gone far before they came to a dead stand—a slight rut in the road into which one of the wheels entered being sufficient to check the horses' advance. Every means was tried to make a new start, but to no purpose ; for powerful as the horses were, they were unable to drag the ponderous weight a single step forward. Not till Mr. Houston, manager of the works, and under whose superintendence the removal was made, had proceeded to the factory, and procurred the assistance of a hundred or two of the men, was the boiler dragged to its destination. The boiler is of excellent construction, and is substantially finished in all its parts. It was built at Mr. Wilson's well-known Lillybank Boiler Works, Glasgow, and is the seventh of the same kind which has come to the town from the same works. We need hardly say that the previous six have given every satisfaction since they were set to work. The following are some of the dimensions of the one which arrived on Thursday :—Length over all, 28 feet ; diameter, 7 feet ; internal fire-boxes, 3 ft. each in diameter. The heating surface is very much increased by all the corners where angle-iron is generally used having round and flanged plates instead—thus admitting of a much larger diameter of fire-boxes than are usually introduced. We need hardly say that the steaming and economical properties of the boiler are greatly increased thereby. The fire-doors have regulating air valves for lessening smoke, and are very simple and neatly arranged. The fitting up and mounting are being done by the same firm. As none of the mounting is either jointed or bolted to the boiler, as is usually done, but is attached to metal beds or stools with planed surfaces, and rivetted to the boiler, leakage between stools and mountings can be easily prevented without the necessity of blowing off the boiler. The man-hole of the boiler is also tightened and strengthened by having a strong metal bed rivetted to it ; and altogether everything has been done to add to the strength and security of this ponderous piece of workmanship by the enterprising firm from whose works it proceeded.—*Dunfermline Saturday Press.*

WORKERS IN SCIENCE, AND SCIENCE CRITICS.—That the disposition to appropriate the labours and discoveries of others is not confined to that class of inventors who occupy a comparatively low rank in the social scale is daily more extensively felt, and for this reason the subjoined observations from the Chemical News may very properly be commended to the attention of these educated appropriators :—"In the so-called 'scientific world' we find a large number of men who do not work. The reasons why they do not work are not always so obvious as one would imagine. Some, including among them many of our most influential and successful men, do not work, simply because they find it unnecessary. Fluent, strong in voice and in nerve ; ambitious, and, perhaps, just the least thing in the world intriguing, they find it far more easy than by working themselves. It is men like these who so mercilessly cross-examine the laborious workers who venture to read their papers before scientific bodies. These cross-examinations are, moreover, often carried on in a semi-bantering tone, as if the student had taken a liberty in bringing his results before a body, some of whose most august members found work unnecessary. And how often, in all countries, do we find the mantles of the greatest workers placed on the shoulders of these very men."

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